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Economic Analysis of

Revised Alternatives for Secretarial Amendment 1 (Red Grouper Rebuilding Plan)

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Introduction

The red grouper (*Epinephelus morio*) resource in the Gulf of Mexico was determined to be overfished (RFSAP 2002).[1] As a result, "Secretarial Amendment 1 to the Gulf of Mexico Fishery Management Council's Reef Fish Fishery Management Plan to set a 10-Year Rebuilding Plan for Red Grouper, with associated Impacts on Gag and other Groupers" was developed. The following analyses of three additional management alternatives to be included in Secretarial Amendment 1 were requested by the National Marine Fisheries Service Southeast Regional Office.

Among the quota actions for shallow-water groupers, include the following alternative:

- The commercial shallow water grouper fishery will close when: 1) the commercial allocation of red grouper (5.31 mp) is reached; or 2) the commercial shallow water grouper allocation in aggregate (8.80 mp) is reached; whichever occurs first.

Among the trip limits for the commercial harvest of groupers, include the following two alternatives:

- Establish a single commercial possession (trip) limit of 7,000 pounds (gutted weight using 1.05 conversion from whole weight to gutted weight) for shallow-water grouper in aggregate.

- The Regional Administrator will have the option, based upon the best available science regarding a possible shallow-water grouper quota overrun, to establish a single commercial possession (trip) limit (gutted weight using 1.05 conversion from whole weight to gutted weight) for shallow-water grouper in aggregate if, by September 30 of the fishing year, the shallow water grouper quota has reached 75% of the aggregate (6.6 mp). The limits will be:
    a. 4,000 pounds gutted weight
    b. 5,000 pounds gutted weight
    c. 6,000 pounds gutted weight
    d. 7,000 pounds gutted weight

[1] RFSAP (Reef Fish Stock Assessment Panel). 2002. September 2002 report of the Reef Fish Stock Assessment Panel: final draft. Report prepared for the Gulf of Mexico Fishery Management Council, 3018 U.S. Highway 301 North, Suite 1000, Tampa, Florida 33619.

Shallow-Water Grouper Quota Actions

The commercial shallow water grouper fishery will close when: 1) the commercial allocation of red grouper (5.31 mp) is reached; or 2) the commercial shallow water grouper allocation in aggregate (8.80 mp) is reached; whichever occurs first.

This management alternative would close the commercial shallow water grouper fishery when either the red grouper or shallow water grouper quota is reached, whichever occurs first. Table A summarizes the recent history of landings for red grouper, gag and all shallow water groupers combined. Data averaged over the 1999-2001 period indicate that commercial fishermen landed 9.00 million pounds of shallow water groupers, including 6.05 million pounds of red grouper. On average for 1999-2001, cumulative landings of red grouper were 5.01 million pounds by the end of October and 5.52 million pounds by the end of November. Hence, the 5.31 million pound quota for red grouper would be reached by approximately mid-November. Similarly, cumulative landings of all shallow water groupers were 8.2 million pounds by the end of November and 9.0 million pounds by the end of December, and the 8.80 million pound quota would be reached in late December. Thus, the proposed quota for red grouper is more restrictive than that for all shallow water groupers; that is, the quota for red grouper, rather than the quota for all shallow water groupers, would trigger a closure.

The seasonal pattern of commercial landings for individual years deviates slightly from the average. Annual data for 1999, 2000 and 2001 indicate that the red grouper quota would have been reached as early as the end of October in 1999 and as late as the end of November in 2001. The shallow water grouper quota would have been reached in early December in 2001, and would not have been reached at all in 1999. In all three years, the quota for red grouper, rather than the quota for shallow water groupers, would have triggered a closure.

Fishery closures compel fishermen to switch to another fishery during the closed season or temporarily stop fishing entirely. Short-term economic losses to commercial fishermen are determined as the difference between how much they would have earned by fishing for shallow water groupers during the closed period and their opportunity costs, defined as their potential earnings in another fishery or in their next-best occupation, if any. In addition, the short-term effects of fishery-wide quotas and seasonal closures depends on how fishermen change their fishing strategies and patterns in response to the regulation. The longer-term effects of fishery-wide quotas and seasonal closures depend on changes in fishing strategies and the potential increases over time in fish stock abundance due to regulatory protection.

Alternatives exist for individual fishermen if they wished to switch from shallow water grouper trips to other kinds of fishing trips. However, a fishery-wide quota and closure would induce mass switching. Fishing pressure is high on most species throughout the Gulf of Mexico, and most of the alternative species probably cannot support the extra fishing pressure that would result from mass switching. In the northern Gulf, the primary alternative species are red and vermilion snappers. Both species are overfished. The red snapper fishery is already heavily regulated, and regulations

are likely for the vermilion snapper fishery. Shallow water groupers support the bulk of the commercial fishing opportunities in west-central Florida. Individual fishermen with bottom longlines could switch to deep water groupers, but the abundance of the deep water groupers does not appear sufficient to support mass switching of fishing effort displaced by a closure of the shallow water grouper fishery. Similarly, individual fishermen with vertical lines could switch to greater amberjack, a variety of snappers, triggerfish and king mackerel, but these species probably cannot support mass switching of fishing effort either. Fishermen will attempt to switch fisheries in response to closure of the shallow water grouper fishery, but the adverse biological effects of additional fishing pressure on these species could result in additional regulations that preclude them as viable alternatives to the shallow water grouper fishery. Therefore, in this analysis, fishermen are assumed to stop fishing during the closure unless their existing trips include catches of species other than shallow water groupers that are sufficiently valuable to cover the costs of fishing.

Logbook trip reports submitted by fishermen to the NMFS were examined for the 1999-2001 period and used to calculate average annual short-term losses to commercial fishermen due to a mid-November closure date for the shallow water grouper fishery. For each trip with bottom longlines or vertical lines, trip revenues earned from species other than shallow water groupers were compared with average trip costs obtained from information provided by grouper fishermen at a workshop held in May 2002. Average trip costs for trips with fish traps were obtained from a 1993 survey (Waters 1996[2]) and updated to 2001 price levels with the Producer Price Index for #2 diesel fuel. If revenues without shallow water groupers exceeded average trip costs, then it is assumed that the trip would be taken despite the closure for shallow water groupers, and that economic losses due to the closure would be determined as the value of shallow water groupers that otherwise would be landed. If revenues without shallow water groupers were less than average trip costs, then it is assumed that the trip would not be taken. If a trip is not taken, then fishermen lose revenues from all species, including those not in the shallow water grouper complex. However, if a trip is not taken, then fishermen also do not incur the cost of fishing. Hence, economic losses for trips not taken due to the closure would be determined as the difference between trip revenues for all species and average trip costs. An estimate of total short-term economic losses to commercial fishermen during the closed season is calculated as the sum of trip losses for all trips landed after mid-November. This method of estimation is an approximation because future fishing trips may not land the same species composition and quantities as during 1999-2001, and because not all fishermen incur costs equal to the averages used here.

The economic effect of a mid-November closure of the shallow water grouper fishery is calculated as the change in net operating income, defined as trip revenues minus trip costs exclusive of captain and crew shares. Hence, it is a measure of the combined income to boat owner, captain and crew after payment of shared expenses but prior to payment of fixed costs by the boat owner and any operating costs incurred by owner, captain or crew that were not shared.

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[2] Waters, James R. 1996. An economic survey of commercial reef fish vessels in the U.S. Gulf of Mexico. National Marine Fisheries Service, 101 Pivers Island Road, Beaufort, NC 28516.

Results by primary gear type are presented in Table B. Fishermen are expected to lose approximately $1.74 million per year, including $1.02 million for boats with bottom longlines, $0.62 million for boats with vertical lines, and $0.11 for boats with other gears. The fishery would close in mid-November, with fishermen landing 5.31 million pounds of red grouper and approximately 7.9 million pounds of shallow water groupers. Thus, the estimated reduction in landings would be approximately 1.11 million pounds of shallow water groupers, including approximately 0.74 million pounds of red grouper.

A fishery-wide quota and closure primarily would affect fishermen who use bottom longlines because they account for the largest share of industry landings (Table B). On average for 1999-2001, fishermen with bottom longlines landed 3.55 million pounds of red grouper and 4.48 million pounds of shallow water groupers. A mid-November closure, based on 1999-2001 average landings, would halt the shallow water grouper fishery after longliners would have landed approximately 3.03 million pounds of red grouper and 3.84 million pounds of shallow water groupers. Therefore, the estimated reduction in landings for bottom longliners would be approximately 0.52 million pounds of red grouper and 0.64 million pounds of shallow water groupers.

Without quota management, boats with bottom longlines landed, on average, 59% of the total red grouper harvest and 50% of the total shallow water grouper harvest. With the proposed quotas, boats with bottom longlines would land 57% of the total red grouper harvest and 49% of the total shallow water grouper harvest. Bottom longliners would incur a disproportionate share of the total estimated reduction in landings of shallow water groupers because monthly landings during the October through December period are greater than average. On the other hand, monthly landings during the October through December period are less than average for boats with vertical lines, fish traps and other gears.

Data averaged for 1999-2001 indicates that boats with bottom longlines normally take approximately 165 trips after the closure date and catch groupers primarily, with only small quantities of other species (Table C). A closure in mid-November is estimated to eliminate all but 24 trips that generate enough revenue from other species to cover their routine trip costs. As a result, boats with bottom longlines are predicted to lose about 92% of the net operating incomes that would ordinarily be earned during the closed period, and about 11% of total annual net operating incomes.

A fishery-wide quota and seasonal closure also would affect fishermen who use vertical lines (Table B). On average for 1999-2001, fishermen with vertical lines landed 1.58 million pounds of red grouper, 1.21 million pounds of gag and 3.48 million pounds of shallow water groupers. They would land approximately 3.09 million pounds of shallow water groupers, including 1.42 million pounds of red grouper, before the fishery would close in mid-November, based on average landings from 1999-2001. Therefore, the estimated reduction in landings for fishermen with vertical lines would be approximately 0.39 million pounds of shallow water groupers, including 0.16 million pounds of red grouper.

From mid-November through the end of the year, net revenues to boat owners, captains and crews are predicted to be approximately $1.27 million without quotas and $0.65 million with quotas and

closures (Table C). Hence, boats with vertical lines are predicted to lose about 49% of the net operating incomes that would ordinarily be earned during the closed period, and about 4% of total annual net operating incomes. As a group, boats with vertical lines would be relatively less affected by a mid-November closure than boats with bottom longlines because the closure would occur at a time of year with slightly below average monthly landings of shallow water groupers, and because the group includes most of the trips that normally catch shallow water groupers in the northern Gulf where they are not the predominant species. Shallow water groupers do not represent the primary source of revenue for many of these trips; hence a closure may not cause them to be cancelled. For example, about 72% of trips during the closure with vertical lines would be cancelled, whereas about 85% of trips with bottom longlines would be cancelled. It is assumed that trips taken during the closure would catch shallow water groupers at the same rate as without a closure, but that they would be discarded.

A fishery-wide quota and seasonal closure would have less of an effect on fishermen who use fish traps and other gears (Table B). On average for 1999-2001, fishermen with fish traps landed 0.89 million pounds of red grouper and 0.94 million pounds of shallow water groupers, with the bulk of their catches occurring between May and September during the closed season for stone crabs. Fishermen with fish traps would land approximately 0.84 million pounds of shallow water groupers before the fishery would close in mid-November, based on average landings from 1999-2001. Therefore, the initial estimated reduction in landings for fishermen with fish traps would be approximately 0.05 million pounds of shallow water groupers, or about 5.6% of their 1999-2001 average landings. On average between 1999 and 2001, fishermen who used other gears landed 0.10 million pounds of shallow water groupers, of which approximately 0.09 million pounds would be landed prior to a mid-November closure. The expected reduction in landings of shallow water groupers would be 0.01 million pounds, or approximately 10% of the 1999-2001 average.

Results by area are presented in Tables D and E. Fishermen are expected to lose approximately $1.74 million per year, including $1.26 million for boats in west-central Florida, $0.34 million for boats in northwest Florida, and $0.14 for boats in other areas.

Boats that fish off the west-central coast of Florida would incur the greatest economic effect (about $1.26 million annually) from a mid-November closure of the shallow water grouper fishery because that is where red grouper primarily exist (Tables D-E). On average for 1999-2001, fishermen landing their catches between NMFS areas 3 and 6 (approximately Collier through Citrus Counties) landed 6.65 million pounds of shallow water groupers, including 5.03 million pounds of red grouper and 1.08 million pounds of gag. A mid-November closure, based on 1999-2001 average landings, would reduce landings of shallow water groupers by approximately 0.81 million pounds, including 0.59 million pounds of red grouper. Boats in west-central Florida are predicted to lose about 94% of the net operating incomes that would ordinarily be earned during the closed period, and about 10% of total annual net operating incomes.

Smaller quantities of red grouper, gag and other shallow water groupers are landed elsewhere in the Gulf of Mexico (Tables D-E). Fishermen between NMFS areas 7 and 10 (approximately Levy County, Florida through Mobile Bay, Alabama) would lose about $0.34 million per year. They

landed, on average from 1999-2001, 1.80 million pounds of shallow water groupers. A closure of the shallow water grouper fishery in mid-November would reduce landings by 0.23 million pounds. Fishermen in the Florida Keys would lose about $0.08 million per year. They landed, on average, 0.34 million pounds of shallow water groupers, of which approximately 0.04 million pounds normally would be landed after the expected closure date in mid-November. Fishermen in the rest of the Gulf of Mexico would lose about $0.06 million per year. They averaged 0.21 million pounds of shallow water groupers, of which 0.3 million pounds normally would be landed after mid-November.

These estimates assume that fishing patterns with quota management would remain the same as without quota management. However, quota management creates incentives for fishermen to accelerate their fishing activities to maximize their shares of the quota before the fishery is closed. Fishermen know that catches that normally would occur after the expected closure date will be lost. Therefore, they probably will plan trips earlier in the season to beat the closure, which results in an earlier-than-expected closure date and could lead to derby fishing when the fishery opens again. There is no formula with which to quantify the likelihood that a derby fishery will occur. Each individual's response to quota management depends on what he thinks his competitors will do. However, fishermen are capable of fishing more intensively if they believe it necessary to stay competitive. If a derby occurs, fishermen who fail to join the race for fish end up with smaller overall catches before the quota is reached and the season is closed. Fishermen compete in the race for fish by investing in additional electronics and more efficient gear designed to reduce search time and increase catches per day fished. Also, they may fish in poor weather and skimp on regular maintenance and repair schedules, which increases the likelihood of engine and gear breakdowns, accidents and injuries. The result is ever-shorter open seasons, higher harvesting and ownership costs to catch the same overall quantity (as defined by the quota), a deterioration in overall level of safety in fishing operations, market gluts because the entire season's landings are no longer spaced throughout the year, and lower ex-vessel prices. Consumers benefit from lower fish prices during the derby. However, traditional marketing channels are interrupted by a closure, with the break in supplies of fresh fish mitigated by increased reliance on frozen fish or imports during the closed season.

The economic inefficiencies of quotas will become more acute over time if management is successful biologically in augmenting the stocks of shallow water groupers. Larger fish populations yield higher catch rates, which enable fishermen to fill the quota more quickly hich, in turn, accentuates the need to race for fish before the season is closed. Higher catch rates also tend to attract additional fishing effort from other fisheries, which further exacerbates the likelihood of derby fishing.

Table A. Monthly distribution of shallow water grouper landings for all gears and all areas in the Gulf of Mexico.
Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1999-2001 AVERAGE LANDINGS													
RED GROUPER	440	386	402	445	569	657	592	589	414	521	510	523	6,045
GAG	198	162	170	183	199	139	102	86	78	134	132	174	1,757
OTHER SWG	128	116	103	120	133	96	83	72	60	88	94	104	1,198
ALL SWG	766	665	675	747	901	892	777	747	552	743	736	800	9,000
1999-2001 CUMULATIVE LANDINGS													
RED GROUPER	440	826	1,228	1,673	2,241	2,898	3,490	4,079	4,492	5,013	5,523	6,045	
GAG	198	360	529	712	911	1,050	1,152	1,238	1,316	1,451	1,583	1,757	
OTHER SWG	128	244	348	467	601	697	779	852	912	1,000	1,094	1,198	
ALL SWG	766	1,430	2,105	2,853	3,754	4,646	5,423	6,170	6,722	7,464	8,201	9,000	
CUMULATIVE LANDINGS AS PERCENTAGE OF RED GROUPER QUOTA													
RED GROUPER	8.3%	15.6%	23.1%	31.5%	42.2%	54.6%	65.7%	76.8%	84.6%	94.4%	104.0%	113.8%	
CUMULATIVE LANDINGS AS PERCENTAGE OF SHALLOW WATER GROUPER QUOTA													
ALL SWG	8.7%	16.3%	23.9%	32.4%	42.7%	52.8%	61.6%	70.1%	76.4%	84.8%	93.2%	102.3%	

Table B. Estimated changes in fishing effort, landings, revenues and net incomes, by primary gear type, due to a closure of the shallow water grouper fishery when a 5.31 MP quota for red grouper or an 8.80 MP quota for shallow water groupers is reached, based on NMFS logbook data averaged for 1999-2001.

WITHOUT QUOTAS						WITH QUOTAS						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,307	3,032	3,840	8,250	2,364	7,937	1,015
% changes compared to harvesting without quotas =						-9.8%	-14.6%	-14.4%	-13.3%	-1.7%	-11.3%	
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	7,706	1,418	3,088	7,097	10,402	13,345	617
% changes compared to harvesting without quotas =						-7.7%	-9.9%	-11.1%	-10.7%	-0.7%	-4.4%	
FISH TRAPS												
531	891	937	1,845	393	1,741	501	838	879	1,733	385	1,648	93
% changes compared to harvesting without quotas =						-5.7%	-5.9%	-6.2%	-6.0%	-2.0%	-5.3%	
OTHER GEARS												
508	30	102	238	252	291	460	28	92	216	246	277	13
% changes compared to harvesting without quotas =						-9.5%	-7.3%	-9.7%	-9.5%	-2.4%	-4.6%	
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	9,973	5,316	7,899	17,296	13,398	23,208	1,739
% changes compared to harvesting without quotas =						-8.0%	-12.1%	-12.2%	-11.5%	-0.9%	-7.0%	

Table C. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a closure of the shallow water grouper fishery when a 5.31 MP quota for red grouper or an 8.80 MP quota for shallow water groupers is reached, based on NMFS logbook data averaged for 1999-2001.

JANUARY TO MID-NOVEMBER SEASON OPEN WITHOUT AND WITH QUOTAS				MID-NOVEMBER THROUGH DECEMBER SEASON OPEN WITHOUT QUOTAS				MID-NOVEMBER THROUGH DECEMBER SEASON CLOSED WITH QUOTAS				
TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,283	8,250	2,223	7,849	165	1,267	181	1,103	24	0	141	88	1,015
VERTICAL LINES												
7,461	7,097	9,589	12,691	887	846	883	1,271	244	0	813	654	617
FISH TRAPS												
493	1,733	346	1,616	38	112	48	125	8	0	40	32	93
OTHER GEARS												
448	216	207	245	59	23	45	45	11	0	39	32	13
ALL GEARS COMBINED												
9,686	17,296	12,365	22,401	1,150	2,248	1,157	2,545	287	0	1,033	806	1,739

Table D. Estimated changes in fishing effort, landings, revenues and net incomes, by area landed, due to a closure of the shallow water grouper fishery when a 5.31 MP quota for red grouper or an 8.80 MP quota for shallow water groupers is reached, based on NMFS logbook data averaged for 1999-2001.

	WITHOUT QUOTAS						WITH QUOTAS						
	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
WEST-CENTRAL FLORIDA (AREAS 3-6)													
	4,761	5,034	6,653	14,181	2,143	12,059	4,288	4,441	5,848	12,566	2,085	10,804	1,255
% changes compared to harvesting without quotas =							-9.9%	-11.8%	-12.1%	-11.4%	-2.7%	-10.4%	
FLORIDA KEYS (AREAS 1-2)													
	876	229	339	733	1,196	1,414	807	201	296	646	1,183	1,339	75
% changes compared to harvesting without quotas =							-7.9%	-12.3%	-12.5%	-11.9%	-1.2%	-5.3%	
NORTHWEST FLORIDA (AREAS 7-10)													
	3,371	771	1,797	4,118	2,632	4,660	3,062	662	1,569	3,636	2,585	4,315	344
% changes compared to harvesting without quotas =							-9.2%	-14.1%	-12.7%	-11.7%	-1.8%	-7.4%	
OTHER AREAS													
	1,828	12	212	512	7,552	6,813	1,816	12	185	447	7,546	6,749	64
% changes compared to harvesting without quotas =							-0.6%	-1.7%	-12.6%	-12.8%	-0.1%	-0.9%	
ALL AREAS COMBINED													
	10,836	6,046	9,001	19,544	13,522	24,946	9,973	5,316	7,899	17,296	13,398	23,208	1,739
% changes compared to harvesting without quotas =							-8.0%	-12.1%	-12.2%	-11.5%	-0.9%	-7.0%	

Table E. Estimated losses in net incomes by area landed for boat owners, captains and crews due to a closure of the shallow water grouper fishery when a 5.31 MP quota for red grouper or an 8.80 MP quota for shallow water groupers is reached, based on NMFS logbook data averaged for 1999-2001.

JANUARY TO MID-NOVEMBER SEASON OPEN WITHOUT AND WITH QUOTAS				MID-NOVEMBER THROUGH DECEMBER SEASON OPEN WITHOUT QUOTAS				MID-NOVEMBER THROUGH DECEMBER SEASON CLOSED WITH QUOTAS				
TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
4,250	12,566	1,958	10,725	511	1,614	185	1,334	38	0	127	79	1,255
VERTICAL LINES												
775	646	1,047	1,230	101	87	149	184	32	0	135	109	75
FISH TRAPS												
2,976	3,636	2,390	4,183	395	482	242	476	86	0	195	132	344
OTHER GEARS												
1,685	447	6,970	6,263	143	65	582	550	131	0	576	486	64
ALL GEARS COMBINED												
9,686	17,296	12,365	22,401	1,150	2,248	1,157	2,545	287	0	1,033	806	1,739

Commercial Grouper Trip Limits

Establish a single commercial possession (trip) limit of 7,000 pounds (gutted weight using 1.05 conversion from whole weight to gutted weight) for shallow-water grouper in aggregate.

This management alternative would establish a 7,000 pound legal maximum quantity of shallow water groupers that may be landed from each trip. Table F summarizes the recent history of landings for shallow water groupers with respect to the proposed 7,000 pound trip limit. Data averaged over the 1999-2001 period indicate that 995 boats landed approximately 9.00 million pounds of shallow water groupers on a total of 10,836 trips. On average, 56 boats reported 153 trips per year with more than 7,000 pounds of shallow water groupers. Approximately 344 thousand pounds of shallow water groupers were landed in excess of the proposed 7,000 pound trip limit.

Table G indicates that boats with bottom longlines make relatively high-volume trips, and hence are more likely than boats with other gears to be affected by the proposed 7,000 pound trip limit. On average for 1999-2001, boats with bottom longlines landed nearly 4.49 million pounds of shallow water groupers, of which 290 thousand pounds (6.5%) were in excess of the proposed 7,000 pound trip limit. In contrast, boats with vertical lines landed 3.48 million pounds of shallow water groupers, of which 27 thousand pounds (0.8%) were in excess of the trip limit. Approximately 16 thousand pounds (1.7%) of shallow water groupers were landed in excess of the trip limit by boats with fish traps.

Table H indicates that fishermen off the west-central coast of Florida averaged 6.65 million pounds of shallow water groupers per year, of which 0.30 million pounds were landed in excess of a 7,000 pound trip limit. Fishermen in all other areas of the Gulf of Mexico landed 0.04 million pounds of shallow water groupers in excess of a 7,000 pound trip limit.

Trip limits prohibit fishermen from landing quantities in excess of the legal limit. Fishermen who normally would catch more than the trip limit can terminate the fishing trip prematurely and return to port. Hence, trip limits, when they constrain landings per trip, reduce revenues per trip and encourage fishermen to take shorter and more frequent fishing trips, which increases overall fuel costs and the amount of non-fishing time spent traveling from port to fishing grounds and back. This outcome is likely when a trip limit is established for species, such as the shallow water groupers, that are the main target species of a trip. Alternatively, fishermen could continue fishing for other species and discard any additional shallow water groupers caught, which reduces revenues per trip and increases fuel consumption for fishermen who change fishing locations to avoid concentrations of the protected species. This outcome is likely when a trip limit is established for a secondary species on a multispecies fishing trip. Trip limits have no economic effects when fishermen catch less than the legal maximum.

Logbook trip reports submitted by fishermen to the NMFS were examined for the 1999-2001 period and used to calculate average annual short-term losses to commercial fishermen due to a 7,000 pound trip limit for shallow water groupers. No short-term losses were recorded for trips that landed less

than the 7,000 pound trip limit. When reported catches of shallow water groupers exceeded 7,000 pounds, revenues were calculated based on the restricted catch and compared with average trip costs. Average costs for trips with bottom longlines and vertical lines were provided by grouper fishermen at a workshop held in May 2002. Average trip costs for trips with fish traps were obtained from a 1993 survey (Waters 1996) and updated to 2001 price levels with the Producer Price Index for #2 diesel fuel. If revenues based on the trip limit exceeded average trip costs, then it is assumed that the trip would be taken despite the trip limit, and that short-term losses would be determined as the difference between the unrestricted and restricted revenues. That is, losses would be calculated as the value of fish that otherwise would be landed in excess of the trip limit. However, if reported landings were multiples of the trip limit and if it would be profitable to fish at the trip limit, then it is assumed that one trip with 14,000 pounds of shallow water groupers would become two trips at 7,000 pounds each, for example. Short-term losses would be determined as the extra harvesting cost required to take the extra trips. If the trip limit would cause revenues to fall below average trip costs, then it is assumed that the trip would not occur and that short-term economic losses would be determined as the difference between trip revenues and average trip costs. An estimate of total short-term economic losses to commercial fishermen is calculated as the sum of trip losses for all trips that landed shallow water groupers in excess of the 7,000 pound trip limit, averaged annually over the 1999-2001 period.

The economic effect of a 7,000 pound trip limit for shallow water groupers is calculated as the change in net operating income, defined as trip revenues minus trip costs exclusive of captain and crew shares. Hence, it is a measure of the combined income to boat owner, captain and crew after payment of shared expenses but prior to payment of fixed costs by the boat owner and any operating costs incurred by owner, captain or crew that were not shared.

Results by primary gear type are presented in Table I for the case when fishermen cannot take extra trips to make up for catches lost due to the trip limit, perhaps due to physical constraints regarding the number of trips that can be taken per week or month, or due to limited periods of time when fish are available in commercial abundance. Boats with bottom longlines are predicted to lose about $0.66 million per year, or 7.4% of the net operating incomes that they would ordinarily earn without a trip limit. Fishermen with other gears infrequently reported trips with more than 7,000 pounds of shallow water groupers, and hence were predicted to incur relatively minor losses due to a 7,000 pound trip limit. Overall, landings of shallow water groupers would decline by 0.34 million pounds, and fishermen are predicted to incur a net loss in incomes of approximately $0.79 million. No trips would have been cancelled due to the trip limit.

Trip limits are not as costly to fishermen when it is profitable and feasible for them to take additional trips. Table J presents the effects of trip limits for the case when fishermen are able to take one additional trip, if profitable, when the original trip is constrained to a 7000 pound trip limit. Boats with bottom longlines are predicted to lose about $0.32 million, or 3.6% of the net operating incomes that would ordinarily be earned without a trip limit. Losses are less than in Table I because the analysis presumed that fishermen would take shorter and more frequent trips in response to the trip limit. On average for 1999-2001, fishermen were found to have made 136 trips per year with landings in excess of the 7,000 pound trip limit (Table G). Table J indicates that fishermen could

take approximately 83 extra trips per year to minimize the potential reduction in landings due to the trip limit. Most of the predicted loss in net incomes is due to the extra harvesting costs required to take extra trips. Fishermen with other gears infrequently reported trips with more than 7,000 pounds of shallow water groupers, and hence were predicted to incur relatively minor losses due to a 7,000 pound trip limit. Overall, fishermen were predicted to take approximately 100 more trips per year than without a 7,000 pound trip limit, and incur a net loss in incomes of approximately $0.39 million per year. Landings of shallow water groupers would decline by approximately 0.08 million pounds.

Results by area are presented in Table K for the case when fishermen cannot take more frequent trips in response to the trip limit. Boats that fish off the west-central coast of Florida would incur a loss of $0.69 million in net incomes to boat owners, captains and crew members due to a 7,000 pound trip limit for shallow water groupers. Fishermen in the Florida Keys would lose about $0.03 million, while fishermen in northwest Florida would lose $0.06 million. Losses would be minimized if fishermen were to take shorter and more frequent trips in response to the trip limit.

These results are approximations. A limitation of the analysis is the use of average trip costs for all trips reported to the logbook program during 1999-2001. Actually, trip costs vary among boats and by duration of trip, with the expectation that larger boats would incur higher trip costs than smaller boats, and that longer trips would incur higher trip costs than shorter trips. This type of analysis would be improved if better data were available about trip costs for individual trips.

The economic effects of trip limits become more acute over time if management is successful biologically in augmenting the stocks of shallow water groupers. Larger fish populations yield higher catch rates. Hence, the fraction of trips constrained by the trip limit would increase, which increases the likelihood for additional boats to adopt a strategy of shorter and more frequent trips. Higher catch rates also tend to attract additional fishing effort from other fisheries.

Table F. Landings of shallow water groupers (SWG) in relation to a 7000 pound trip limit, all gears and areas in the Gulf of Mexico.
Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

FISHING YEAR	TOTAL BOATS	BOATS OVER LIMIT	BOATS OVER LIMIT PERCENT	TOTAL TRIPS	TRIPS OVER LIMIT	TRIPS OVER LIMIT PERCENT	TOTAL SWG POUNDS GUTTED (1000s)	SWG POUNDS WITHIN LIMIT (1000s)	SWG POUNDS OVER LIMIT (1000s)	SWG POUNDS OVER LIMIT PERCENT
1999	997	46	4.6%	11,281	140	1.2%	8,649	8,356	293	3.4%
2000	1,019	63	6.2%	11,116	141	1.3%	8,914	8,573	341	3.8%
2001	968	58	6.0%	10,110	178	1.8%	9,439	9,042	397	4.2%
AVG	995	56	5.6%	10,836	153	1.4%	9,001	8,657	344	3.8%

Table G. Landings of shallow water groupers (SWG) in relation to a 7000 pound trip limit, by primary gear for each trip.
Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

PRIMARY GEAR	FISHING YEAR	TOTAL BOATS	BOATS OVER LIMIT	BOATS OVER LIMIT PERCENT	TOTAL TRIPS	TRIPS OVER LIMIT	TRIPS OVER LIMIT PERCENT	TOTAL SWG POUNDS GUTTED (1000s)	SWG POUNDS WITHIN LIMIT (1000s)	SWG POUNDS OVER LIMIT (1000s)	SWG POUNDS OVER LIMIT PERCENT
VERTICAL	1999	811	2	0.2%	8,807	2	0.0%	2,932	2,929	3	0.1%
LINES	2000	843	11	1.3%	8,528	13	0.2%	3,621	3,573	48	1.3%
	2001	797	6	0.8%	7,710	10	0.1%	3,874	3,845	29	0.7%
	AVG	817	6	0.8%	8,348	8	0.1%	3,476	3,449	27	0.8%
BOTTOM	1999	157	43	27.4%	1,461	135	9.2%	4,800	4,512	288	6.0%
LONGLINES	2000	167	48	28.7%	1,463	112	7.7%	4,036	3,784	251	6.2%
	2001	156	50	32.1%	1,422	160	11.3%	4,625	4,295	330	7.1%
	AVG	160	47	29.4%	1,449	136	9.4%	4,487	4,197	290	6.5%
FISH	1999	61	1	1.6%	564	3	0.5%	840	838	2	0.2%
TRAPS	2000	59	4	6.8%	544	16	2.9%	1,148	1,105	42	3.7%
	2001	53	3	5.7%	485	7	1.4%	822	817	5	0.6%
	AVG	58	3	4.6%	531	9	1.6%	937	920	16	1.7%
OTHER	1999	98	0	0.0%	449	0	0.0%	76	76	0	0.0%
GEARS	2000	130	0	0.0%	581	0	0.0%	110	110	0	0.0%
	2001	108	1	0.9%	493	1	0.2%	118	85	34	28.8%
	AVG	112	0	0.3%	508	0	0.1%	101	90	11	11.2%

Table H. Landings of shallow water groupers (SWG) in relation to a 7000 pound trip limit, by region where landed.

Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

PRIMARY GEAR	FISHING YEAR	TOTAL BOATS	BOATS OVER LIMIT	BOATS OVER LIMIT PERCENT	TOTAL TRIPS	TRIPS OVER LIMIT	TRIPS OVER LIMIT PERCENT	TOTAL SWG POUNDS GUTTED (1000s)	SWG POUNDS WITHIN LIMIT (1000s)	SWG POUNDS OVER LIMIT (1000s)	SWG POUNDS OVER LIMIT PERCENT
FLORIDA	1999	207	2	1.0%	898	9	1.0%	395	374	20	5.1%
KEYS	2000	195	2	1.0%	873	2	0.2%	288	286	2	0.7%
	2001	182	4	2.2%	856	9	1.1%	333	318	15	4.5%
	AVG	195	3	1.4%	876	7	0.8%	339	326	12	3.6%
WEST-	1999	474	44	9.3%	4,950	126	2.5%	6,675	6,416	259	3.9%
CENTRAL	2000	476	57	12.0%	5,022	126	2.5%	6,642	6,341	301	4.5%
FLORIDA	2001	442	55	12.4%	4,312	150	3.5%	6,641	6,300	341	5.1%
	AVG	464	52	11.2%	4,761	134	2.8%	6,653	6,352	300	4.5%
NORTHWEST	1999	322	4	1.2%	3,310	5	0.2%	1364	1350	13	1.0%
FLORIDA	2000	343	11	3.2%	3,415	13	0.4%	1,759	1,720	39	2.2%
	2001	334	8	2.4%	3,388	17	0.5%	2269	2246	23	1.0%
	AVG	333	8	2.3%	3,371	12	0.3%	1,797	1,772	25	1.4%
OTHER	1999	178	0	0.0%	2,123	0	0.0%	215	215	0	0.0%
AREAS	2000	195	0	0.0%	1,806	0	0.0%	225	225	0	0.0%
	2001	170	2	1.2%	1,554	2	0.1%	196	178	18	9.2%
	AVG	181	1	0.4%	1,828	1	0.0%	212	206	6	2.8%

Table I. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 7000 pound trip limit for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips can be taken when the trip limit is constraining.

NO TRIP LIMIT						7000 POUND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,449	3,338	4,197	8,889	2,374	8,292	660
% changes compared to harvesting without a trip limit =						0.0%	-6.0%	-6.5%	-6.6%	-1.3%	-7.4%	
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	8,348	1,561	3,449	7,884	10,467	13,899	63
% changes compared to harvesting without a trip limit =						0.0%	-0.9%	-0.8%	-0.7%	0.0%	-0.5%	
FISH TRAPS												
531	891	937	1,845	393	1,741	531	874	920	1,815	393	1,711	30
% changes compared to harvesting without a trip limit =						0.0%	-1.8%	-1.7%	-1.6%	0.0%	-1.7%	
OTHER GEARS												
508	30	102	238	252	291	508	29	90	210	241	251	40
% changes compared to harvesting without a trip limit =						0.0%	-5.6%	-11.0%	-12.1%	-4.4%	-13.7%	
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	10,836	5,802	8,657	18,798	13,475	24,153	793
% changes compared to harvesting without a trip limit =						0.0%	-4.0%	-3.8%	-3.8%	-0.3%	-3.2%	

Table J. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 7000 pound trip limit for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001, and assuming that one extra trip can be taken, if profitable, when the trip limit is constraining.

NO TRIP LIMIT						7000 POUND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,532	3,509	4,429	9,388	2,400	8,633	319
% changes compared to harvesting without a trip limit =						5.8%	-1.2%	-1.3%	-1.4%	-0.2%	-3.6%	
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	8,356	1,572	3,470	7,929	10,470	13,942	21
% changes compared to harvesting without a trip limit =						0.1%	-0.2%	-0.2%	-0.2%	0.0%	-0.1%	
FISH TRAPS												
531	891	937	1,845	393	1,741	538	885	931	1,834	393	1,724	18
% changes compared to harvesting without a trip limit =						1.3%	-0.7%	-0.6%	-0.6%	0.0%	-1.0%	
OTHER GEARS												
508	30	102	238	252	291	508	29	93	216	244	259	32
% changes compared to harvesting without a trip limit =						0.1%	-4.4%	-8.7%	-9.6%	-3.5%	-10.9%	
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	10,934	5,995	8,922	19,367	13,506	24,558	389
% changes compared to harvesting without a trip limit =						0.9%	-0.9%	-0.9%	-0.9%	-0.1%	-1.6%	

Table K. Estimated losses in net incomes, by area landed, for boat owners, captains and crews due to a 7000 pound trip limit for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001. and assuming that no extra trips can be taken when the trip limit is constraining.

NO TRIP LIMIT						7000 POUND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
WEST-CENTRAL FLORIDA (AREAS 3-6)												
4,761	5,034	6,653	14,181	2,143	12,059	4,761	4,817	6,353	13,529	2,107	11,373	686
% changes compared to harvesting without a trip limit =						0.0%	-4.3%	-4.5%	-4.6%	-1.6%	-5.7%	
FLORIDA KEYS (AREAS 1-2)												
876	229	339	733	1,196	1,414	876	219	326	707	1,192	1,383	31
% changes compared to harvesting without a trip limit =						0.0%	-4.3%	-3.7%	-3.6%	-0.4%	-2.2%	
NORTHWEST FLORIDA (AREAS 7-10)												
3,371	771	1,797	4,118	2,632	4,660	3,371	753	1,772	4,065	2,629	4,604	56
% changes compared to harvesting without a trip limit =						0.0%	-2.2%	-1.4%	-1.3%	-0.1%	-1.2%	
OTHER AREAS												
1,828	12	212	512	7,552	6,813	1,828	12	206	496	7,547	6,793	20
% changes compared to harvesting without a trip limit =						0.0%	-2.7%	-2.8%	-3.1%	-0.1%	-0.3%	
ALL AREAS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	10,836	5,802	8,657	18,798	13,475	24,153	793
% changes compared to harvesting without a trip limit =						0.0%	-4.0%	-3.8%	-3.8%	-0.3%	-3.2%	

Commercial Grouper Trip Limits

The Regional Administrator will have the option, based upon the best available science regarding a possible shallow-water grouper quota overrun, to establish a single commercial possession (trip) limit (gutted weight using 1.05 conversion from whole weight to gutted weight) for shallow-water grouper in aggregate if, by September 30 of the fishing year, the shallow water grouper quota has reached 75% of the aggregate (6.6 mp). The limits will be:

a. 4,000 pounds gutted weight
b. 5,000 pounds gutted weight
c. 6,000 pounds gutted weight
d. 7,000 pounds gutted weight

This alternative combines quota management with trip limits, and would close the commercial shallow water grouper fishery when either the red grouper or shallow water grouper quota is reached, whichever occurs first. It differs from Quota Alternative 5 in that a commercial trip limit would be implemented from the beginning of October until the fishery was closed if at least 75% of the 8.80 million pound quota for shallow water groupers (i.e., 6.60 million pounds) had been filled by September 30. The intent of the trip limit is to slow the industry's rate of harvest to keep the fishery open as long as possible. Four alternative trip limits are proposed, ranging from 4,000 to 7,000 pounds.

Table A summarizes the monthly distribution of landings for shallow water groupers. The overall level of harvest varies annually, and would have triggered implementation of a trip limit in 1999 and 2001, but not in 2000. On average for 1999-2001, approximately 6.72 million pounds of shallow water groupers were landed by the end of September. Hence, on average, a trip limit would be implemented during the 4th quarter of the calendar year.

Table L summarizes fishing effort and landings of shallow water groupers with respect to 4th quarter trip limits of 7000 pounds, 6000 pounds, 5000 pounds and 4000 pounds. The 7000 pound trip limit is the least restrictive. On average for 1999-2001, 32 boats made 52 trips that landed 0.13 million pounds of shallow water groupers in excess of a 7000 pound trip limit. In contrast, 80 boats made 160 trips that landed 0.43 million pounds of shallow water groupers in excess of a more restrictive 4000 pound trip limit. Thus, if the fishery were to remain open throughout the 4th quarter, a 7000 pound trip limit would affect approximately 2.1% of total annual trips and potentially reduce landings by up to 5.9%, whereas a 4000 pound trip limit would affect 6.4% of trips and potentially reduce landings by up to 18.8%.

However, the fishery would not remain open with any of the trip limits that have been proposed for the 4th quarter. With an expected closure date in mid-November, a 5.31 million pound quota for red grouper or 8.80 million pound quota for all shallow water groupers combined would result in a potential reduction in shallow water grouper landings of approximately 1.11 million pounds (Table B). The maximum potential reduction in landings from a 4th quarter trip limit would be approximately 0.43 million pounds with a 4000 thousand pound trip limit.

Logbook data were examined for the 1999-2001 period and used to calculate average annual short-term losses to commercial fishermen due to the combination of management by quota and various 4th quarter trip limits. The analytical method is similar to that used previously. If revenues based on a 4th quarter trip limit exceeded average trip costs, then it is assumed that the trip would be taken despite the trip limit, and that short-term losses would be determined as the difference between the unrestricted and restricted revenues. If the trip limit would cause revenues to fall below average trip costs, then it is assumed that the trip would not occur and that short-term economic losses would be determined as the difference between trip revenues and average trip costs. In addition, the accumulated landings of red grouper and all shallow water groupers were calculated and the fishery closed when the more restrictive quota was filled. Short-term losses for trips that would have occurred after the closure date were determined as the difference between trip revenues and average trip costs. An estimate of total short-term economic losses to commercial fishermen is calculated as the sum of trip losses for all trips that would have been affected by either the 4th quarter trip limit or the closure, averaged annually over the 1999-2001 period.

Results by primary gear type are presented in Tables M-P for the case when fishermen cannot take more frequent trips in response to the trip limit. Overall losses would be approximately $1.79-$1.80 million per year regardless of the level of trip limit because the quota would restrict the overall quantity landed. Fishermen with bottom longlines would incur greater losses than fishermen with other gears. With quotas and a 7000 pound trip limit in the 4th quarter, fishermen with bottom longlines would incur a $1.11 million loss in net revenues to owners, captains and crews, whereas fishermen with other gears would incur combined losses of approximately $0.68 million (Table M). With quotas and a 4000 pound trip limit in the 4th quarter, fishermen with bottom longlines would incur a $1.30 million loss in net revenues to owners, captains and crews, whereas fishermen with other gears would incur combined losses of $0.50 million (Table P). Although the level of trip limit does not affect overall losses in the fishery, as the 4th quarter trip limit becomes more restrictive, there would be a redistribution of losses from boats with vertical lines, fish traps and other gears to boats with bottom longlines. The redistribution occurs because trips with bottom longlines are more likely than other trips to be constrained by a trip limit, and additional trips would be constrained as the trip limit declines from 7000 pounds to 4000 pounds. As the trip limit becomes more restrictive and additional longline trips are constrained, the duration of the open season lengthens and allows boats with other gears to take additional trips. The expected closing date would have ranged from November 7 in 1999 to December 3 in 2001 with a 7000 pound trip limit, and from November 14 in 1999 to December 9 in 2001 with a 4000 pound trip limit. These dates were based on harvesting practices from 1999-2001. If quota management creates a race for fish, then more trips would be taken earlier in the year, and the quota would be filled and the fishery closed earlier than predicted here.

Quota management creates incentives for fishermen to accelerate their fishing activities to maximize their shares of the quota before the fishery is closed. Fishermen compete in the race for fish by investing in additional electronics and more efficient gear designed to reduce search time and increase catches per day fished. Also, they may fish in poor weather and skimp on regular maintenance and repair schedules, which increases the likelihood of engine and gear breakdowns, accidents and injuries. The result is ever-shorter open seasons, higher harvesting and ownership

costs to catch the same overall quantity (as defined by the quota), a deterioration in overall level of safety in fishing operations, market gluts because the entire season's landings are no longer spaced throughout the year, and lower ex-vessel prices. Consumers benefit from lower fish prices during the derby. However, traditional marketing channels are interrupted by a closure, with the break in supplies of fresh fish mitigated by increased reliance on frozen fish or imports during the closed season.

Management with trip limits creates incentives for fishermen to take shorter and more frequent fishing trips. When trip limits are implemented without quotas, these incentives enable fishermen to minimize the adverse effects of management (e.g., compare Tables I and J). However, the opposite outcome occurs when quotas and trip limits are implemented simultaneously. Fishermen still have an incentive to take more frequent trips, but by doing so, they cause the quota to be filled and the season to be closed more quickly. In aggregate, fishermen would take slightly fewer trips because the open season would be shorter, and tend to incur greater losses due to the longer closed season. For example, with a 4,000 pound trip limit and the ability to take one additional trip, if profitable when the trip limit is constraining, fishermen with all gears and in all areas combined would take approximately 10,114 trips and incur losses of $1.90 million (Table Q), whereas they would take approximately 10,297 trips and incur losses of $1.80 million (Table P) when they are unable to take more frequent trips.

The economic inefficiencies of quotas and trip limits will become more acute over time if management is successful biologically in augmenting the stocks of shallow water groupers. Larger fish populations yield higher catch rates, which enable fishermen to fill trip limits and quotas more quickly which, in turn, accentuates the need to race for fish before the season is closed. Higher catch rates also tend to attract additional fishing effort from other fisheries, which further exacerbates the likelihood of derby fishing.

Table L. Landings and fishing effort for shallow water groupers (SWG) in relation to various trip limits during the 4th calendar quarter.
Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

TRIP LIMIT	FISHING YEAR	TOTAL BOATS	BOATS OVER LIMIT	BOATS OVER LIMIT PERCENT	TOTAL TRIPS	TRIPS OVER LIMIT	TRIPS OVER LIMIT PERCENT	TOTAL SWG POUNDS GUTTED (1000s)	SWG POUNDS WITHIN LIMIT (1000s)	SWG POUNDS OVER LIMIT (1000s)	SWG POUNDS OVER LIMIT PERCENT
7000 LBS	1999	655	17	2.6%	2,444	25	1.0%	1,823	1,736	87	4.8%
	2000	661	46	7.0%	2,601	81	3.1%	2,759	2,569	189	6.9%
	2001	638	33	5.2%	2,470	49	2.0%	2,255	2,129	126	5.6%
	AVG	651	32	4.9%	2,505	52	2.1%	2,279	2,145	134	5.9%
6000 LBS	1999	655	26	4.0%	2,444	43	1.8%	1,823	1,701	122	6.7%
	2000	661	59	8.9%	2,601	111	4.3%	2,759	2,474	284	10.3%
	2001	638	50	7.8%	2,470	74	3.0%	2,255	2,068	187	8.3%
	AVG	651	45	6.9%	2,505	76	3.0%	2,279	2,081	198	8.7%
5000 LBS	1999	655	40	6.1%	2,444	70	2.9%	1,823	1,647	176	9.7%
	2000	661	78	11.8%	2,601	162	6.2%	2,759	2,337	421	15.3%
	2001	638	62	9.7%	2,470	109	4.4%	2,255	1,977	279	12.4%
	AVG	651	60	9.2%	2,505	114	4.5%	2,279	1,987	292	12.8%
4000 LBS	1999	655	65	9.9%	2,444	121	5.0%	1,823	1,553	270	14.8%
	2000	661	97	14.7%	2,601	213	8.2%	2,759	2,150	609	22.1%
	2001	638	77	12.1%	2,470	147	6.0%	2,255	1,851	404	17.9%
	AVG	651	80	12.2%	2,505	160	6.4%	2,279	1,851	428	18.8%

Table M. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and a 7000 pound trip limit during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips are possible when the trip limit is constraining.

WITHOUT QUOTAS AND TRIP LIMIT						WITH QUOTAS AND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,321	3,016	3,820	8,196	2,357	7,847	1,105
% changes compared to harvesting with quotas and trip limits =						-8.8%	-15.0%	-14.9%	-13.9%	-2.0%	-12.3%	12.3%
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	7,772	1,426	3,113	7,152	10,412	13,381	582
% changes compared to harvesting with quotas and trip limits =						-6.9%	-9.5%	-10.4%	-10.0%	-0.6%	-4.2%	4.2%
FISH TRAPS												
531	891	937	1,845	393	1,741	504	841	883	1,741	386	1,654	88
% changes compared to harvesting with quotas and trip limits =						-5.0%	-5.5%	-5.7%	-5.6%	-1.7%	-5.0%	5.0%
OTHER GEARS												
508	30	102	238	252	291	464	28	92	217	247	278	12
% changes compared to harvesting with quotas and trip limits =						-8.5%	-7.0%	-9.0%	-8.9%	-2.1%	-4.2%	4.2%
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	10,061	5,312	7,908	17,306	13,402	23,160	1,786
						-7.1%	-12.1%	-12.1%	-11.4%	-0.9%	-7.2%	7.2%

Table N. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and a 6000 pound trip limit during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips are possible when the trip limit is constraining.

WITHOUT QUOTAS AND TRIP LIMIT						WITH QUOTAS AND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,326	3,011	3,813	8,174	2,355	7,812	1,139
% changes compared to harvesting with quotas and trip limits =						-8.4%	-15.2%	-15.0%	-14.1%	-2.1%	-12.7%	12.7%
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	7,801	1,431	3,129	7,186	10,415	13,403	559
% changes compared to harvesting with quotas and trip limits =						-6.6%	-9.1%	-10.0%	-9.5%	-0.5%	-4.0%	4.0%
FISH TRAPS												
531	891	937	1,845	393	1,741	505	840	881	1,737	387	1,650	91
% changes compared to harvesting with quotas and trip limits =						-5.0%	-5.7%	-5.9%	-5.8%	-1.7%	-5.2%	5.2%
OTHER GEARS												
508	30	102	238	252	291	467	28	93	218	247	279	12
% changes compared to harvesting with quotas and trip limits =						-8.1%	-6.7%	-8.7%	-8.5%	-2.0%	-4.2%	4.2%
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	10,099	5,311	7,916	17,315	13,404	23,145	1,802
% changes compared to harvesting with quotas and trip limits =						-6.8%	-12.2%	-12.0%	-11.4%	-0.9%	-7.2%	7.2%

Table O. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and a 5000 pound trip limit during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips are possible when the trip limit is constraining.

WITHOUT QUOTAS AND TRIP LIMIT						WITH QUOTAS AND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,335	2,999	3,798	8,133	2,353	7,750	1,201
% changes compared to harvesting with quotas and trip limits =						-7.8%	-15.5%	-15.4%	-14.5%	-2.2%	-13.4%	13.4%
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	7,853	1,444	3,167	7,266	10,423	13,466	497
% changes compared to harvesting with quotas and trip limits =						-5.9%	-8.3%	-8.9%	-8.5%	-0.5%	-3.6%	3.6%
FISH TRAPS												
531	891	937	1,845	393	1,741	507	839	881	1,736	387	1,648	93
% changes compared to harvesting with quotas and trip limits =						-4.6%	-5.8%	-6.0%	-5.9%	-1.6%	-5.4%	5.4%
OTHER GEARS												
508	30	102	238	252	291	470	28	93	219	248	279	12
% changes compared to harvesting with quotas and trip limits =						-7.5%	-6.8%	-8.2%	-8.1%	-1.8%	-4.0%	4.0%
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	10,164	5,311	7,938	17,354	13,410	23,143	1,803
% changes compared to harvesting with quotas and trip limits =						-6.2%	-12.2%	-11.8%	-11.2%	-0.8%	-7.2%	7.2%

Table P. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and a 4000 pound trip limit during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips are possible when the trip limit is constraining.

WITHOUT QUOTAS AND TRIP LIMIT						WITH QUOTAS AND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,349	2,972	3,769	8,064	2,347	7,650	1,302
% changes compared to harvesting with quotas and trip limits =						-6.9%	-16.3%	-16.0%	-15.3%	-2.4%	-14.5%	14.5%
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	7,960	1,464	3,227	7,399	10,438	13,561	402
% changes compared to harvesting with quotas and trip limits =						-4.6%	-7.0%	-7.2%	-6.9%	-0.3%	-2.9%	2.9%
FISH TRAPS												
531	891	937	1,845	393	1,741	512	847	889	1,751	388	1,660	81
% changes compared to harvesting with quotas and trip limits =						-3.6%	-5.0%	-5.1%	-5.1%	-1.3%	-4.7%	4.7%
OTHER GEARS												
508	30	102	238	252	291	476	28	94	220	249	279	12
% changes compared to harvesting with quotas and trip limits =						-6.2%	-7.4%	-7.7%	-7.6%	-1.5%	-4.1%	4.1%
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	10,297	5,311	7,978	17,435	13,422	23,149	1,797
% changes compared to harvesting with quotas and trip limits =						-5.0%	-12.2%	-11.4%	-10.8%	-0.7%	-7.2%	7.2%

Table Q. Estimated losses in net incomes, for all gears and areas combined, for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and various trip limits during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that one extra trip can be made, if profitable, when the trip limit is constraining.

WITHOUT QUOTAS AND TRIP LIMIT						WITH QUOTAS AND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
7000 POUND TRIP LIMIT												
10,836	6,046	9,001	19,544	13,522	24,946	10,015	5,312	7,900	17,300	13,401	23,156	1,790
% changes compared to harvesting with quotas and trip limits =						-7.6%	-12.1%	-12.2%	-11.5%	-0.9%	-7.2%	7.2%
6000 POUND TRIP LIMIT												
10,836	6,046	9,001	19,544	13,522	24,946	10,031	5,311	7,901	17,304	13,401	23,140	1,806
% changes compared to harvesting with quotas and trip limits =						-7.4%	-12.2%	-12.2%	-11.5%	-0.9%	-7.2%	7.2%
5000 POUND TRIP LIMIT												
10,836	6,046	9,001	19,544	13,522	24,946	10,069	5,311	7,904	17,308	13,403	23,106	1,840
% changes compared to harvesting with quotas and trip limits =						-7.1%	-12.2%	-12.2%	-11.4%	-0.9%	-7.4%	7.4%
4000 POUND TRIP LIMIT												
10,836	6,046	9,001	19,544	13,522	24,946	10,114	5,312	7,909	17,313	13,404	23,048	1,898
% changes compared to harvesting with quotas and trip limits =						-6.7%	-12.1%	-12.1%	-11.4%	-0.9%	-7.6%	7.6%